PHOTOGRAPH THIS SHEET

ADA081138

DTIC ACCESSION NUMBER

II

LEVEL

INVENTORY

AEWES Misc. Paper No. 4-436

DOCUMENT IDENTIFICATION

Dtd. July 1961

DISTRIBUTION STATEMENT A
Approved for public release;
Distribution Unlimited

DISTRIBUTION STATEMENT

ACCESSION FOR		
NTIS	GRA&I	☒
DTIC	TAB	☐
UNANNOUNCED		☐
JUSTIFICATION		
BY		
DISTRIBUTION /		
AVAILABILITY CODES		
DIST	AVAIL AND/OR SPECIAL	
A	23 CP	

DISTRIBUTION STAMP

DTIC
ELECTE
S FEB 28 1980 D
D

DATE ACCESSIONED

80 2 27 063

DATE RECEIVED IN DTIC

PHOTOGRAPH THIS SHEET AND RETURN TO DTIC-DDA-2

DTIC FORM OCT 79 70A

DOCUMENT PROCESSING SHEET

DISCLAIMER NOTICE

THIS DOCUMENT IS BEST QUALITY PRACTICABLE. THE COPY FURNISHED TO DDC CONTAINED A SIGNIFICANT NUMBER OF PAGES WHICH DO NOT REPRODUCE LEGIBLY.

INTERIM REPORT OF EXPERIMENTAL CRACK SEALING IN ASPHALTIC CONCRETE PAVEMENTS, THULE AIR BASE, GREENLAND 8-24 AUGUST 1960

MISCELLANEOUS PAPER NO. 4-436

July 1961

U. S. Army Engineer Waterways Experiment Station
CORPS OF ENGINEERS
Vicksburg, Mississippi

ARMY-MRC VICKSBURG, MISS.

134m
a. 4-436

Waterways Exp Sta
May 1961

INTERIM REPORT OF EXPERIMENTAL CRACK SEALING IN ASPHALTIC CONCRETE PAVEMENTS THULE AIR BASE, GREENLAND 8-24 AUGUST 1960

Authority

1. The U. S. Army Engineer Waterways Experiment Station (WES) was requested to participate and assist in experimental sealing of cracks at Thule Air Base in a letter from the U. S. Army Engineer District, Eastern Ocean, dated 11 July 1960, subject "Experimental Crack Sealing in Airfield Pavement, Thule, Greenland." The Office, Chief of Engineers, was notified of WES participation in this project in a telephone conversation between Mr. Z. D. Fry of WES and Mr. F. B. Hennion of OCE on 7 July 1960.

Purpose

2. The primary purpose of the experimental crack sealing discussed herein was to determine the performance of various sealing compounds under severe arctic conditions. It was also desired to determine the effects of variations in width, depth, and shape of cut when preparing the cracks for sealing, and also the difficulties and approximate costs involved.

Description of Site

3. Thule Air Base is located on the northwestern coast of Greenland and is one of the most northerly locations where asphaltic concrete pavement is in use. The air temperature ranges from approximately +50°F to -50°F and is conducive to the formation of shrinkage cracks at relatively

close spacing throughout the pavement. The field has experienced approximately six years of severe and widespread pavement cracking with somewhat unsuccessful repair with grade AP-1 asphalt cement. The presence of permafrost subgrade adds to the problem. The amount of rainfall is generally very small, but there are occasional heavy rains. This rain water and the melted snow in the spring enter the pavement cracks and tend to hasten thaw and degradation of the surface of the permafrost subgrade. At the time of the experimental sealing the base was receiving sufficient traffic to permit observation of the sealed pavements under traffic conditions, and maintenance forces were available to observe and report the performance of the sealers.

Location of Test Areas

4. Two areas were selected for the tests; one area was between sta 14+00 and 15+00 on the west end of the primary runway 16-34, and the other was in the southeast corner of the northeast (NE) warm-up apron (see plate 1). The typical pattern and amount of cracks occurring on the runway location at the time of the 1957 crack survey are shown on plate 2. Details of location of the cracks selected for the tests are shown on plates 3 and 4 respectively for the runway and NE warm-up apron areas. Both areas are outside the limits of the large area of the pavement surface which was being painted white to reduce the depth of thaw during the summer months.

Description of Cracks

5. Both of the selected test areas contained numerous cracks. The cracks varied from very narrow, hairline openings to very wide (1-1/2 in.)

openings. Although the depth could not be determined for each crack, it is believed that all cracks extend through the bituminous pavement and the wider cracks extend well into the base course. The narrow hairline cracks were generally spaced 5 to 10 ft in both directions, the medium cracks (1/4 to 3/8 in. wide) were usually spaced 10 to 20 ft apart, and the 1/2-in.-wide cracks were spaced about 20 to 40 ft apart. The very wide (1 to 1-1/2 in.) cracks were more randomly spaced at 40 to 100 ft. Many of the cracks, particularly those 1/4 in. wide and larger, had been sealed previously with grade AP-1 (100 to 120 penetration) asphalt cement without routing or other preparation of the cracks. Photographs 1 through 6 show various typical cracks in both test areas. Many variable conditions were available for the tests, and a list of the cracks selected for sealing and a description of their condition are shown in table 1. The cracks on the runway location are numbered 1 through 9 and those on the NE warm-up apron are numbered 10 through 16.

Materials Selected for Testing

6. Four different types of sealing material were selected for the tests. The selection was based on previous experience with the materials and a few tests that were made for determining the compatibility of the materials with asphaltic concrete.

a. Allied material (hereinafter referred to as AM). A special hot-poured, non-JFR material prepared by Allied Materials Corp., Stroud, Okla., that is supposed to be soft and more plastic in cold climates.

b. Para-Plastic (hereinafter referred to as PP). A hot-poured non-JFR material produced by Servicised Products Corp., Chicago, Ill.

c. Pro-Seal 959, type A, with primer 778 (hereinafter referred to as CPS). A polysulfide, two-component, cold-mixed material produced by Coast Pro-Seal and Manufacturing Co., Los Angeles, Calif.

d. Protex-A-Cote (hereinafter referred to as PAC). A two-component, cold-mixed, epoxy-polysulfide material produced by Protex-A-Cote, Inc., Newark, N. J.

Equipment Used in Tests

7. The equipment and accessories used in the work were a Windsor router, infrared joint and crack heater, air-powered wire brush, asphalt heating kettle, and miscellaneous items such as pouring cans, mixers, solvents, etc.

8. The Windsor router, which was used for the initial preparation of the crack, consists of a four-cycle, single-cylinder Briggs and Stratton engine mounted on two main wheels about 8 in. in diameter with a small, 2-in.-diameter caster wheel which provides a means of guiding the machine as it is pulled along the length of the crack. Steel bits mounted vertically and driven by a belt-and-pulley arrangement from the engine were used to cut and rout the cracks. The bits are produced in various sizes; those used in this work were 1/2 and 1 in. in diameter with a depth of cut of about 1-3/4 in. The bits are pointed on the cutting end and contain hardened carbon inserts for cutting edges. The Windsor router is shown on photograph 7.

9. A self-powered wire brush was not available so a device was constructed on the site. It consisted of an air-powered rotary tool attached to the lower portion of a small two-wheel warehouse dolly. A Y-connection provided a means of passing air through a piece of tubing and blowing it

directly behind the wire brush, thus cleaning all debris from the crack. The equipment was powered by a portable air compressor unit, which was also used to blow out the prepared cuts as the final effort in cleaning. The wire brush, while possibly a somewhat crude arrangement, performed very satisfactorily. The device is shown on photograph 8.

10. A 165-gal-capacity asphalt kettle was used for preparing the hot-poured type of material. The kettle and heating element were mounted on two wheels so as to be suitable for towing. Heat was supplied by diesel fuel, under pressure, which was vaporized in the heating element and provided a blowtorch type of flame directed into an enclosure at the bottom of the kettle. A circulating pump attached was inoperative and was therefore not used.

11. The infrared heater was a special piece of equipment obtained for the purpose of preheating the cold faces of the prepared cracks prior to application of the hot-poured materials. The hand-propelled apparatus (photograph 9) was mounted on rubber-tired wheels and consisted of an enclosure or hood containing four sets of screens in an inverted V. The infrared heat was converted from the burning of propane gas which was supplied in two 20-lb trailer-type bottles.

12. Miscellaneous items included 1-gal cans with pouring spouts or 1-gal pails with a crimped V pouring spout. Large spoons and a stirring device driven by an electric motor were used for mixing the two-component materials. The solvents used for cleaning were tetrachloroethane and toluol, the latter furnished with the PAC material. A portable air compressor was used for power and for final air cleaning of the prepared cracks.

Preparation of Cracks for Sealing

13. The cracks selected for the experimental sealing were first routed with the Windsor router using both the 1/2- and 1-in.-diameter bits separately or in combination, i.e., making the initial cut with 1/2-in. bit followed with 1-in. bit, or vice versa. The crack number, bit size used, and final dimensions of ..c are shown in table 1.

14. The cutting with the 1/2-in. bit was very tedious and slow, mostly because the asphaltic concrete was cold and hard and cutting was difficult. However, this condition and the slowness of operation probably prevented some tearing or fraying along the sides of the groove. Cracks 1 and 2 on the runway were routed with the 1/2-in. bit, which required approximately 45 to 60 minutes for each 32 ft of cracks, and a good, smooth cut approximately 7/8 in. wide and 7/8 in. deep was obtained (photographs 10 and 11). Three passes of the router were required to obtain these dimensions; and it was determined that a light initial cut along the crack followed by the deeper additional cuts required to reach the desired depth was the best procedure.

15. The 1-in. bit cut much faster, usually 1 to 2 ft per minute, depending on the depth of cut. The initial cut could be made rapidly and usually produced a groove 1/2 to 5/8 in. wide and 1/4 to 3/8 in. deep (photograph 12). The second pass increased the width and depth to 1 in. and 5/8 in., respectively (photograph 13). A third and possibly fourth pass would provide a groove 1-1/2 in. wide and 1-1/2 in. deep (photograph 14), but rate of cut was about 1 ft per minute. Thus, a crack 1-1/2 in. deep could be prepared with the 1-in. bit at a rate of cut of approximately 1 ft, or slightly less, per minute.

16. Cracks were also prepared by cutting first with the 1-in. bit and then deeper with the 1/2-in. bit. This method produced grooves 7/8 to 1 in. wide and 7/8 to 1-1/2 in. deep (cracks 4, 5, and 7). This method was somewhat faster than cutting with the 1/2-in. bit alone and probably produced a groove more satisfactory, particularly in width, than that produced by cutting the entire depth with the 1-in. bit.

17. As stated in paragraph 5, the majority of the cracks had been sealed with grade AP-1 asphalt cement. Excess material usually was left along each edge of the crack (photograph 3), and this was to some extent a deterrent to the routing operation. In some instances the excess material was stripped off with sharp, heavy blades (photograph 15). This was not too difficult as the asphalt was cold and brittle, but the operation required a considerable amount of time and hand labor. The old seal material remaining in and along the crack was softened and melted by the action of the bit and the hot exhaust direct[illegible] the cut and tended to "gum up" around the bit and in the crack. To remove the old sealer completely, it was usually necessary to resort to hand scraping or to cutting a very wide groove; the latter was considered impractical. Thus, many of the prepared grooves still contained amounts of the old sealer, particularly along the surface edges of the groove (photographs 5 and 13).

18. One condition that was common to use of both sizes of bits was closure of the bottom of the groove, which eliminated prefilling with some material to prevent excessive flow or use of sealing material into deeper portions of the cracks, which extended into the base course.

19. After routing was completed, the groove was cleaned with a wire brush (photograph 8), and final cleaning prior to sealing was accomplished with a jet of compressed air.

Preparation and Application of Sealing Materials

20. The four types of sealing material were received in lots of approximately 30 gal each.

21. The AM and PP were in congealed form when received and required heating to obtain a state sufficiently fluid for pouring. Instructions on the containers stated that the maximum temperature should not exceed 380°F. With the heating kettle previously described, it was somewhat difficult to control the heating temperature; and even though considerable effort was made to control the temperature, there were times, particularly in the initial stages of melting both the AM and PP, when the temperature rose above 400°F. At the time, the overheating did not appear to damage the materials; and at the higher temperatures, both materials were much easier to pour into the prepared grooves, particularly the narrower ones. The hot-poured materials were hand-poured into the prepared groove with ordinary garden-type watering cans with spouts. About 2 gal could be handled at one time, and this amount of material usually did not cool or begin to congeal before it could be poured into the groove. Except for the long period of time (approximately 4 to 6 hours) required for melting and heating the material, this operation was easily accomplished. Both the AM and PP materials "set" rather quickly with no resulting "tackiness" on the exposed surface.

22. The CPS and PAC materials were received with the components in separate containers in which they could be mixed. The base component of the CPS was in 5-gal cans and the accelerator was in 1/2-gal cans, thus providing an easy means of preparation. The PAC was somewhat more difficult

to blend as it required a 1:1 proportion of base and accelerator, both of which arrived in 5-gal cans. Mixing was accomplished in a thoroughly cleaned half of a 55-gal drum cut for this purpose. Thorough mixing was accomplished with a 1/4-in. steel rod bent in an L shape and powered by an electric drill motor.

23. The CPS was more fluid than the PAC and, with a "pot life" of about four hours, was easy to mix, get to the test areas, and pour before setting. The PAC, with a "pot life" of 20 to 28 minutes, presented a few problems in this respect; and several gallons had to be discarded at first because the material set up before it could be poured. Because of this fast set time, the amount of PAC to be prepared at any one time was limited to approximately 3 gal for this particular test situation.

24. It is difficult to estimate the exact amounts of material required for sealing the prepared cracks because of the variation in width and depth of cracks and because there was no means of determining the amount of wasted material. Also, a considerable amount of the material not needed to fill the prepared cracks was used to seal open cracks in immediately adjacent areas. (These open cracks were not cleaned in any manner.) It is estimated that approximately 20 gal of PP was required for the 194-1/2 ft of cracks prepared (as shown in table 1). The remaining 8 to 10 gal was used in adjacent open cracks. The 165 ft of prepared cracks sealed with the AM required approximately 15 to 18 gal of material, the remaining 10 to 12 gal being used in other areas. Only 10 gal of the CPS was required for the 133-1/2 ft of prepared cracks, and about 10 to 12 gal of PAC was required for 136 ft of prepared cracks. Some of the material was used in the adjacent open cracks; and, of course, about 6 or 7 gal of the PAC was discarded

when it "set" before it could be placed. The remaining 20 gal of CPS and 10 gal of PAC, along with instructions for mixing and pouring, were left with the Air Force Civil Engineer.

25. It had been the belief that due to extremely low temperatures the asphaltic concrete would be very cold and would require preheating prior to application of the hot-poured types of sealing materials. Thermocouples had been previously installed at several locations to determine thawing conditions; and from information obtained from these instruments and measurements made by placing a thermometer on the pavement surface, it was indicated that the temperature of the asphaltic concrete was usually 52-60°F during the period of the experimental sealing. It was therefore planned to preheat the pavement by use of the infrared heater. Initial efforts to use the heater were thwarted to some extent because there remained on the surface some previously placed sealing material which softened very rapidly under the heat and began flowing into the crack. This situation prevented continued use of the heater in such areas; however, it was used in areas where sealing material had not been previously placed. Even then, the heater had to be moved along rapidly or the asphaltic concrete would become very soft. It was believed that this softening would affect the density of the pavement; and as there was no means of rolling or recompacting the asphaltic concrete, the heater was not used extensively. There was no indication that there was any difference between performance of the hot-poured sealing material placed in a prepared crack that had been preheated and the material placed in a crack that had not been preheated. The best use of the infrared heater was obtained by passing over cracks that

had been previously sealed where the sealing material had hardened and had come loose from the sides of the crack. The heater softened the old sealing material, both in the crack and the excess on the surface, which would then flow into and reseal the crack (photographs 16 through 20). This operation could be performed very rapidly and appeared to be very effective.

Final Inspection of Completed Work

26. The materials were observed daily following their placement to determine their adequacy for use in this area. During the short period of time remaining before departure of WES personnel, no particular change was noted in any of the materials used.

27. The AM and PP materials remained soft and pliable, with the AM probably being a little softer, and neither gave any indication of stripping loose. Both showed good adherence, even under the impact of landing aircraft.

28. The PAC became quite hard and brittle once it had set and it appeared to be as hard as the adjacent asphaltic pavement, if not harder. The time required for set was usually less than 25 minutes. The PAC also had good adherence with no visible appearance of loosening under aircraft traffic.

29. The CPS remained very soft longer than did the other materials, some areas requiring as much as 36 hours to set up in the existing weather conditions. During this period, the material was sometimes splattered out of the groove by tires of landing aircraft, as indicated in photographs 28, 29, 36, and 37. After set had occurred, the CPS was somewhat soft and appeared to have about the same consistency as the AM and PP materials. There was also some indication that it could be pulled by hand from the cracks.

30. Color photographs 21 through 38 show the sealing materials in place. The captions on the photographs are self-explanatory.

31. The weather conditions were reasonably good during the period the work was performed (table 2). However, the sealing was completed shortly before the time that snow and ice would start accumulating on the pavement surface.

32. The Thule Air Force Base Civil Engineer agreed to have periodic inspections of the areas made by personnel of the Roads and Grounds Section to obtain information for evaluating the sealers. A supply of check-off sheets was provided for reporting the observed conditions. Monthly reports received since completion of the work indicate either no change or that the area is covered with snow and ice. Hence, a full evaluation cannot be made before the summer of 1961.

Discussion

33. Although many problems were encountered in performing the work and the controls of heating and applying the materials probably left something to be desired, it is believed that sufficient material was installed under conditions encountered in the area to provide information on selection of materials and equipment for use in future sealing operations in this and similar locations. It is anticipated that a thorough inspection will be made in the early summer of 1961 to determine more conclusively the effectiveness of the sealing materials and to select materials for any additional sealing which may be required.

Plates 1-4
Tables 1-2
Photographs 1-38

Table 1

Description of Cracks, and Sealing Materials Used

Crack No.	Description Before Routing	After Routing: Length ft	After Routing: Width in.	After Routing: Depth in.	Bit Size in.	Sealing Material ft	Sealing Material No.*	Remarks
1	Small hairline, knife blade width	32	3/4 to 7/8	7/8	1/2	16	3	Very little old sealer remained and this was removed
						16	4	
2	Medium crack, 1/8 to 1/4 in. Possibly wider in spalled areas	32	3/4 to 7/8	7/8 to 1	1/2	16	1	Some old sealer remained in crack where No. 2 was placed
						16	2	
3	Wider crack on runway center line, 1/4 in.+ in spalled areas	9	1-1/2	1-1/2	1	9	1	No old sealer in these cracks
						17	1	
		64	3/4	1	1/2	22	2	
						11	3	
						14	4	
4	Wide crack, 1/4 to 3/8 in., and appeared to go very deep	6	1-1/2	1 to 1-1/4	1	6	2	Considerable amount of old sealer remained, but this was removed prior to sealing
		60	7/8 to 1	7/8 to 1	1, 1/2	21	1	
						18	2	
						10	3	
						11	4	
5	Medium crack, 1/8 to 1/4 in. wide	52	1	1 to 1-1/8	1, 1/2	26	1	No old sealing material in this area
						26	2	
6	Very wide crack on surface, 1/2 in.+ deep	20	1-1/2	1-1/2	1	10	3	
						10	4	
7	Hairline to medium, 1/16 to possibly 1/8 in.	30	7/8 to 1	1-1/8	1, 1/2	15	3	Very little old sealer
						15	4	
8	Medium crack, 1/8 in. wide	24	1	5/8	1	6	1	Crack had been previously filled with AP-1
						6	2	
						6	3	
						6	4	
		50	1/2 to 5/8	1/4 to 3/8	1	12	1	Cleaned off excess of old sealing material
						12	2	
						12	3	
						14	4	
9	Hairline crack, possibly to 1/16 in. in width	48	3/4	3/8 to 1/2	1	16	1	Considerable amount of old sealer remained which was not removed
						16	2	
						16	3	
						16	4	
10	Crack was 1/4 in. wide and could be measured to a depth of 2 in.	20	1	5/8 to 3/4	1	10	1	Considerable amount of old sealer which was not removed
						17	2	
11	Hairline, 1/16 in. wide	21	1	5/8 to 3/4	1	10	1	No old sealing material in this area
						11	4	
12	Hairline, 1/16 in. wide	20-1/2	1	5/8	1	10-1/2	2	No old sealing material in this area
						10	3	
13	Crack was 1/2 in. wide and very deep	20	1-1/4 to 1-1/2	1-1/4	1	10	2	Crack previously sealed with AP-1. Old sealer along edges and in lower portion of crack about 1 1/4 in. from surface
		31-1/2	7/8 to 1-1/4	3/4 to 7/8	1	10	4	
						11	1	
						11-1/2	2	
						9	3	
14	Crack was 3/16 in. wide and very deep	14	1/2	3/8	1	7	2	Previously filled with AP-1
						7	4	
15	Crack was 1/4 in. wide	20	1	3/4	1	10	2	Previously filled with AP-1
						10	3	
16	Crack was very wide, 1/2 to 1-1/2 in., and deep	32	1-1/4 to 1-1/2	1-3/8 to 2-1/2	1	11	1	Crack previously filled with AP-1. Also appeared to have considerable moisture but did dry out
						6-1/2	2	
						8-1/2	3	
						6	4	

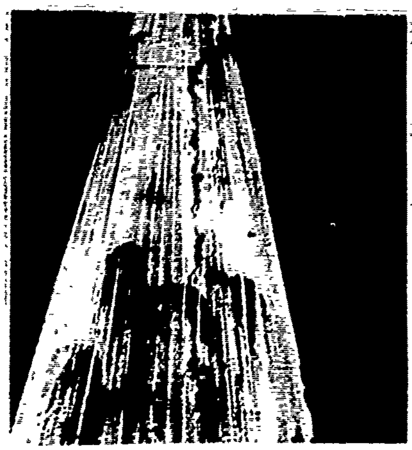
* 1 - Allied material
2 - Para-Plastic
3 - Coast Pro-Seal
4 - Protex-A-Cote

Table 2

Weather Data - 11-22 Aug 1960

Date	12:00 Night / Noon	1:00 A.M. / P.M.	2:00 A.M. / P.M.	3:00 A.M. / P.M.	4:00 A.M. / P.M.	5:00 A.M. / P.M.	6:00 A.M. / P.M.	7:00 A.M. / P.M.	8:00 A.M. / P.M.	9:00 A.M. / P.M.	10:00 A.M. / P.M.	11:00 A.M. / P.M.	Max	Min	Remarks
	Temperature, °F														
11	43.1 41.3	42.2 40.8	40.2 42.1	40.0 43.9	39.2 43.1	39.1 43.6	42.7 45.1	38.2 46.1	37.8 45.4	40.3 42.9	41.7 43.9	42.4 45.2	46	38	Intermittent fog
12	43.4 44.6	41.2 47.3	41.9 44.8	41.7 44.9	45.1 47.0	42.9 46.7	44.9 46.1	44.2 46.0	43.4 44.7	45.6 43.4	47.3 44.4	43.8 44.2	47	41	Overcast to clear and sunny
13	40.2 44.6	43.1 46.1	42.3 46.2	41.9 43.5	41.1 44.3	41.5 42.2	43.0 42.9	44.8 41.9	43.8 41.6	42.9 42.3	45.6 42.0	44.8 41.3	46	40	Sunny to overcast
14	35.7 36.3	39.2 37.8	38.6 37.6	38.2 37.2	38.9 37.7	40.6 37.6	36.9 37.1	36.5 36.3	35.8 36.1	36.7 36.9	35.6 36.1	36.4 35.6	41	36	Fog - trace rain
15	42.7 43.8	35.4 44.9	35.1 46.1	34.4 49.2	35.0 49.8	34.2 47.9	33.8 47.4	35.1 47.6	35.6 47.1	35.9 45.7	39.2 46.2	40.7 44.8	50	34	Fog
16	44.4 47.1	41.1 48.4	41.8 49.2	41.2 48.7	42.3 48.5	43.9 48.1	44.1 47.2	43.8 48.8	44.4 48.4	48.6 47.9	47.3 46.6	47.8 44.8	49	41	Overcast
17	42.1 50.2	45.7 47.9	45.0 46.9	44.8 45.7	44.2 44.1	44.6 44.4	45.2 43.8	45.3 43.9	45.2 43.7	47.3 42.2	48.7 42.6	49.9 42.1	50	42	Rain - fog
18	35.7 39.8	41.2 40.1	41.8 39.6	41.2 40.4	41.8 41.4	41.2 40.4	41.2 38.7	41.0 37.7	40.5 37.3	42.2 36.4	40.3 36.1	40.9 36.3	42	36	Fog
19	36.4 39.2	35.8 43.1	35.5 42.1	35.1 42.1	33.9 42.8	34.8 42.9	35.9 43.6	37.1 41.5	36.2 40.8	38.2 39.9	38.3 37.3	38.2 36.2	44	34	Intermittent fog
20	34.8 33.9	35.8 33.9	35.9 34.3	34.2 34.8	33.2 35.0	33.8 35.7	33.9 35.8	33.7 35.1	33.5 35.2	33.2 35.2	33.6 35.9	33.6 35.4	36	33	Fog
21	37.6 34.9	34.5 37.8	34.1 35.5	31.9 36.1	30.3 35.4	31.1 35.6	31.3 36.8	30.6 38.1	31.9 37.7	32.4 36.7	33.9 36.4	34.6 36.7	38	30	Fog
22															Overcast to clear and sunny

Photograph 1. Crack No. 1 on runway location prior to sealing. This was a very narrow, hairline-type crack.

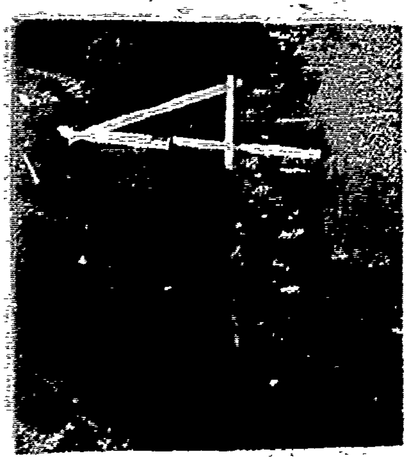


Photograph 2. Crack No. 3 on runway location prior to routing. This was a longitudinal crack on runway centerline 1/4 in. or more in width.

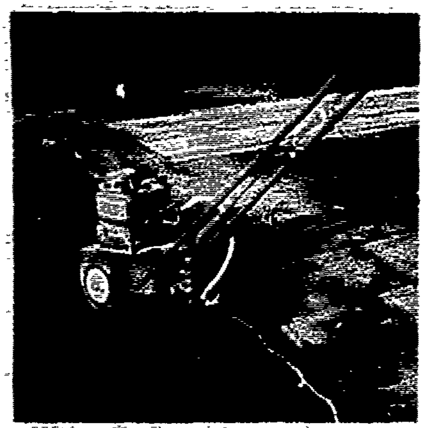
Photograph 3. Crack No. 4 on runway location showing previous sealing with AP-1.

Photograph 4. Crack No. 5 on runway location prior to routing. This was a medium crack 1/5 to 1/4 in. in width.

Photograph 5. Crack No. 13 on northeast warm-up apron location prior to routing. Crack was 1/2 in. wide and filled with old sealing material to within 3/4 in. of pavement surface.



Photograph 6. Crack No. 16 on northeast warm-up apron prior to routing. Crack contained a considerable amount of water from previous rain.



Photograph 7. Windsor router machine used in preparation of cracks for sealing.

Photograph 8. Wire brush apparatus fabricated on site to clean cracks prior to sealing.

Photograph 9. Infrared heater used for heating interior of prepared groove and surrounding pavement prior to pouring of the sealing materials.

Photograph 10. Crack No. 1 on runway location after routing with 1/2-in.-diameter bit.

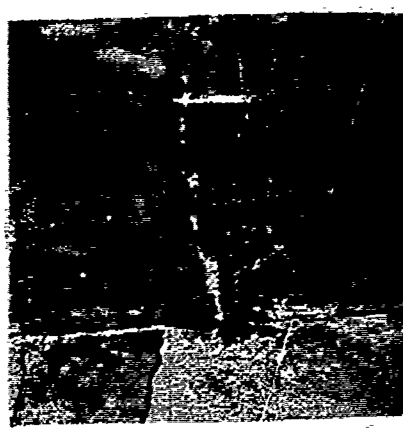
Photograph 11. Crack No. 2 on runway location after routing with 1/2-in.-diameter bit.

Photograph 12. Crack No. 8 on runway location routed with one pass of 1-in.-diameter bit.

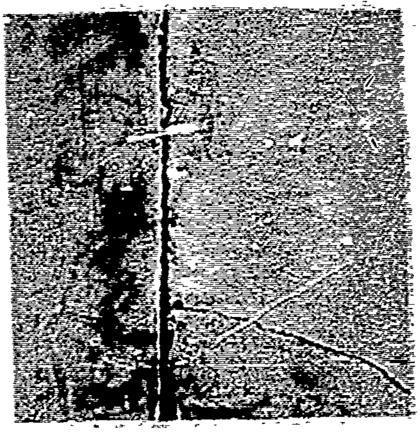
Photograph 13. Crack No. 8 on runway location routed with two passes of 1-in.-diameter bit. Note previous heavy application of AP-1 asphalt cement sealer.

Photograph 14. Crack No. 3 on runway location showing depth of portion routed with three passes of 1-in.-diameter bit.

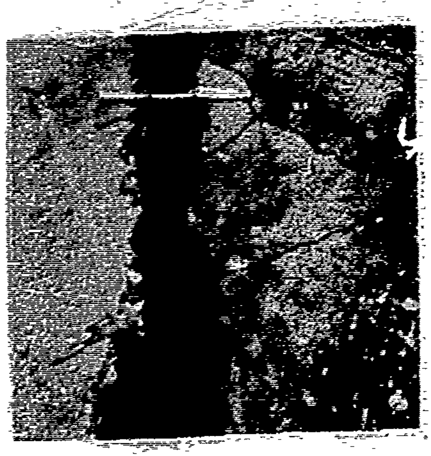
Photograph 15. Crack No. 6 on runway location before routing showing extent of previously applied sealing material.



Photograph 16. Crack previously sealed with AP-1 asphalt cement prior to use of infrared heater.

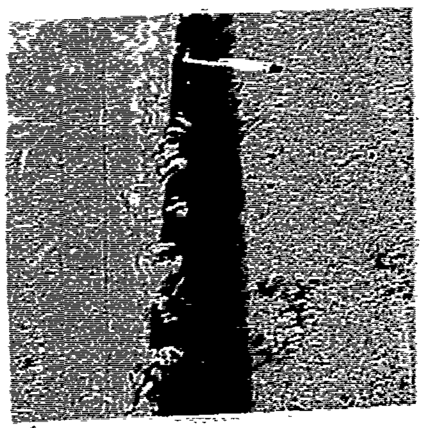


Photograph 17. Typical condition of crack, previously filled, prior to use of infrared heater.

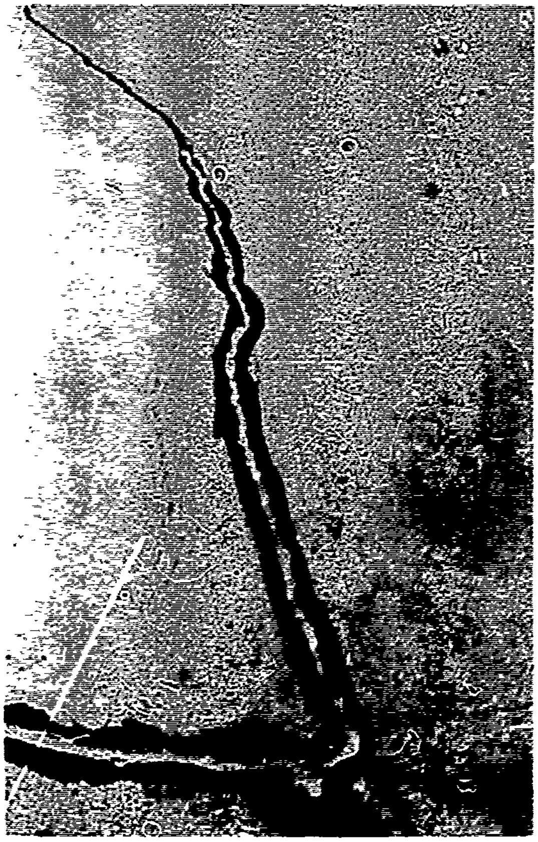


Photograph 18. Effect of infrared heater on old cracks previously sealed with AP-1 asphalt cement.

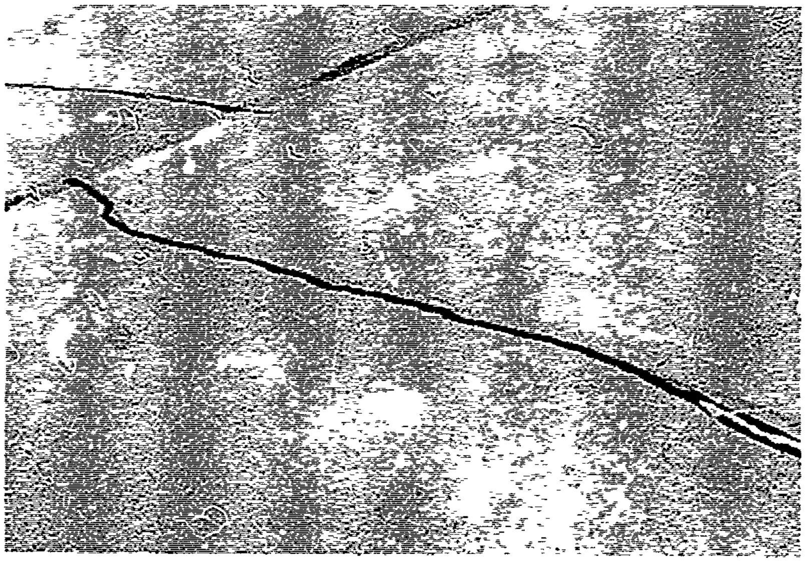
Photograph 19. Previously sealed crack after use of infrared heater.



Photograph 20. Unprepared crack, previously filled, heated with infrared heater and sealed with Allied material.

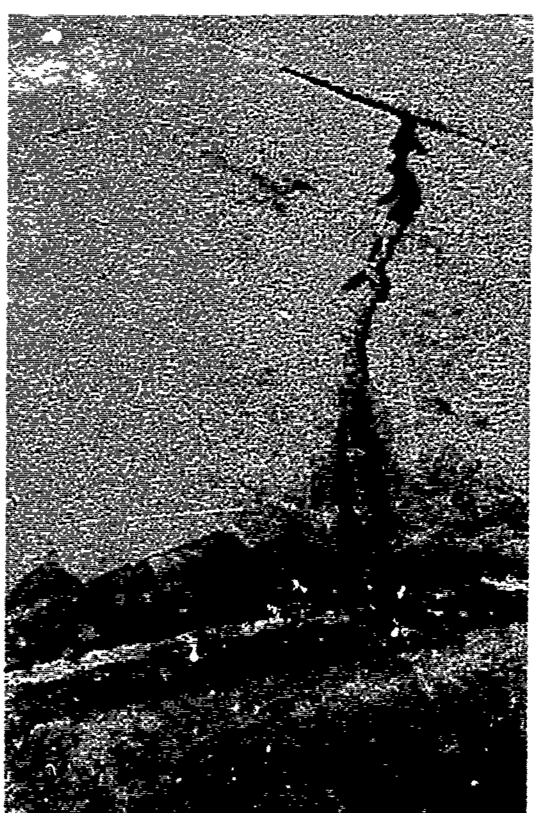


[illegible]

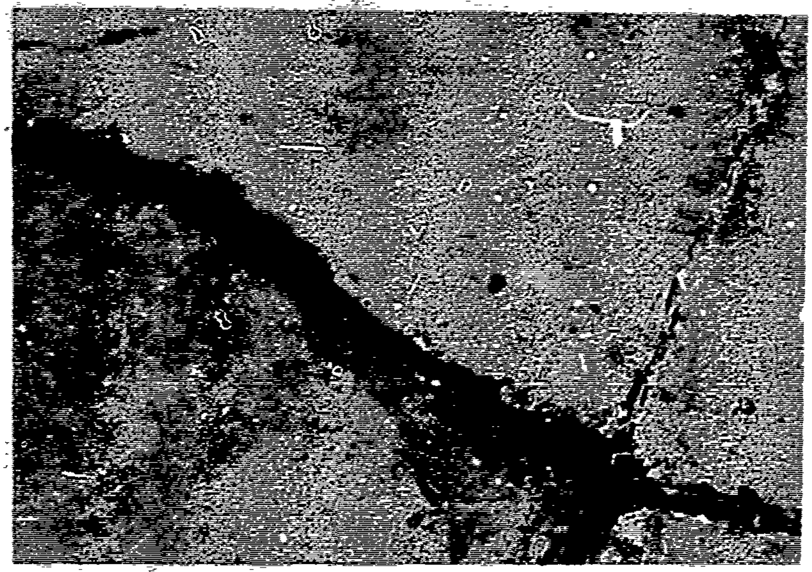


[illegible]. F[illegible]-Plus[illegible] in crack No. 12 on [illegible]east [illegible] apron.

[illegible]



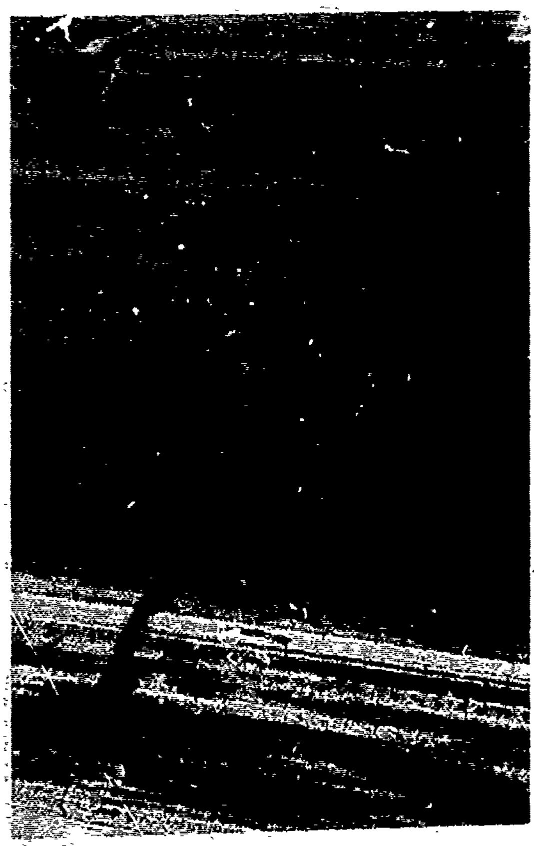
[illegible]



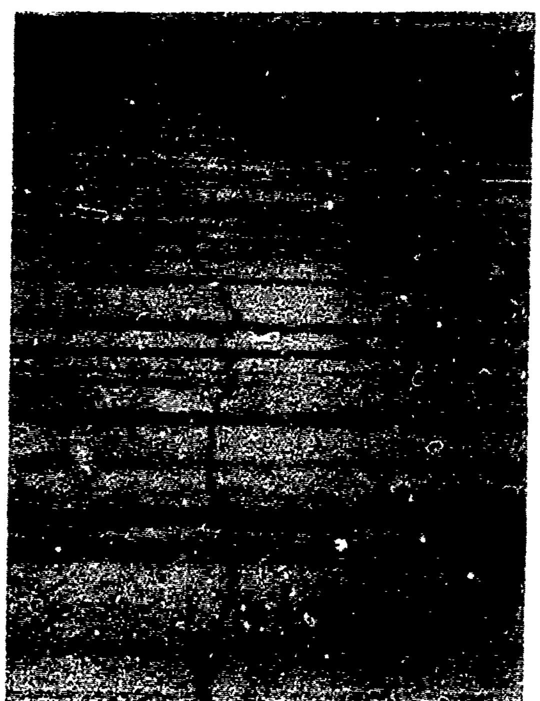
Photograph 25. Allied material in crack No. [illegible] on northeast warm-up apron.

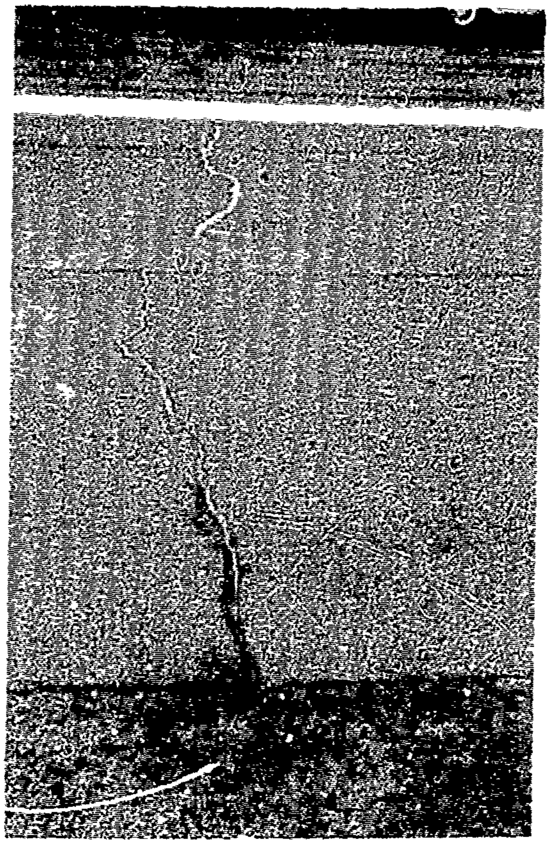
Photograph [illegible]. Coast Pro-Seal in crack No. 15 on northeast warm-up apron.

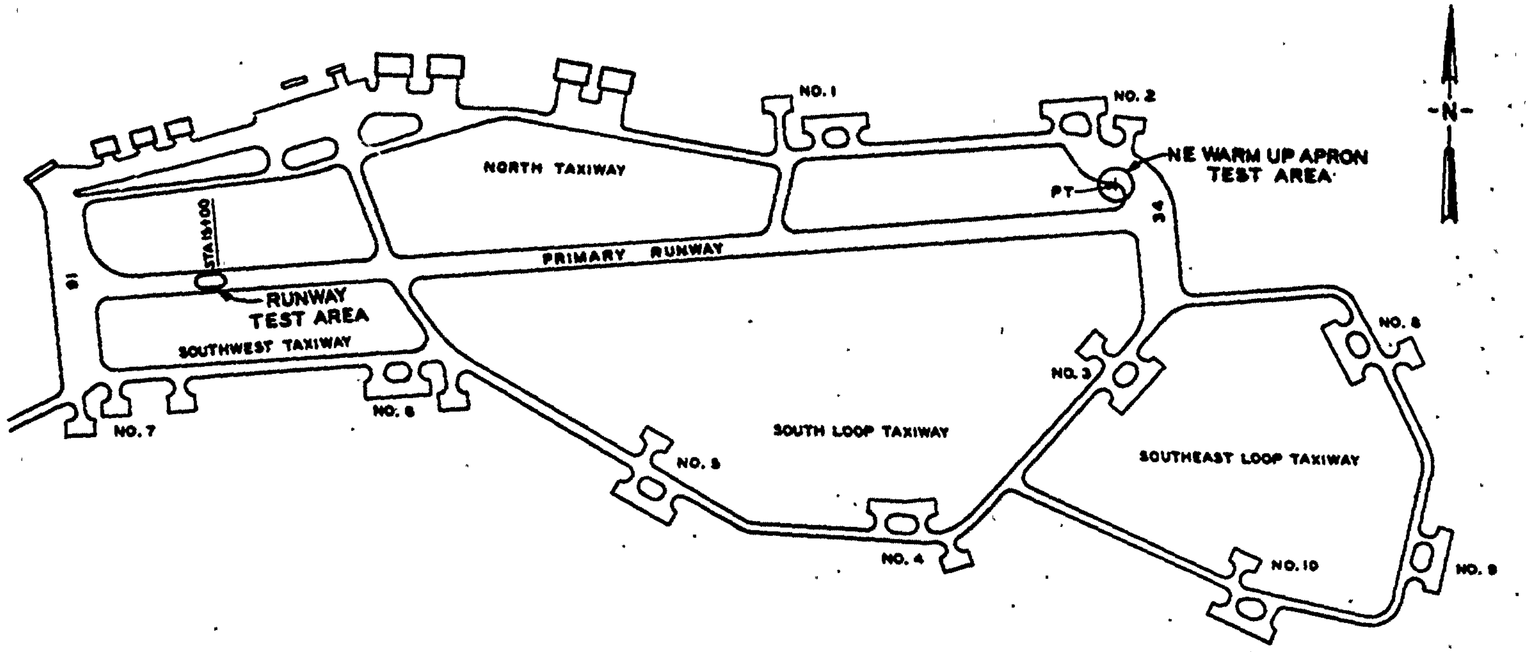
Photograph [illegible]



Photograph [illegible]





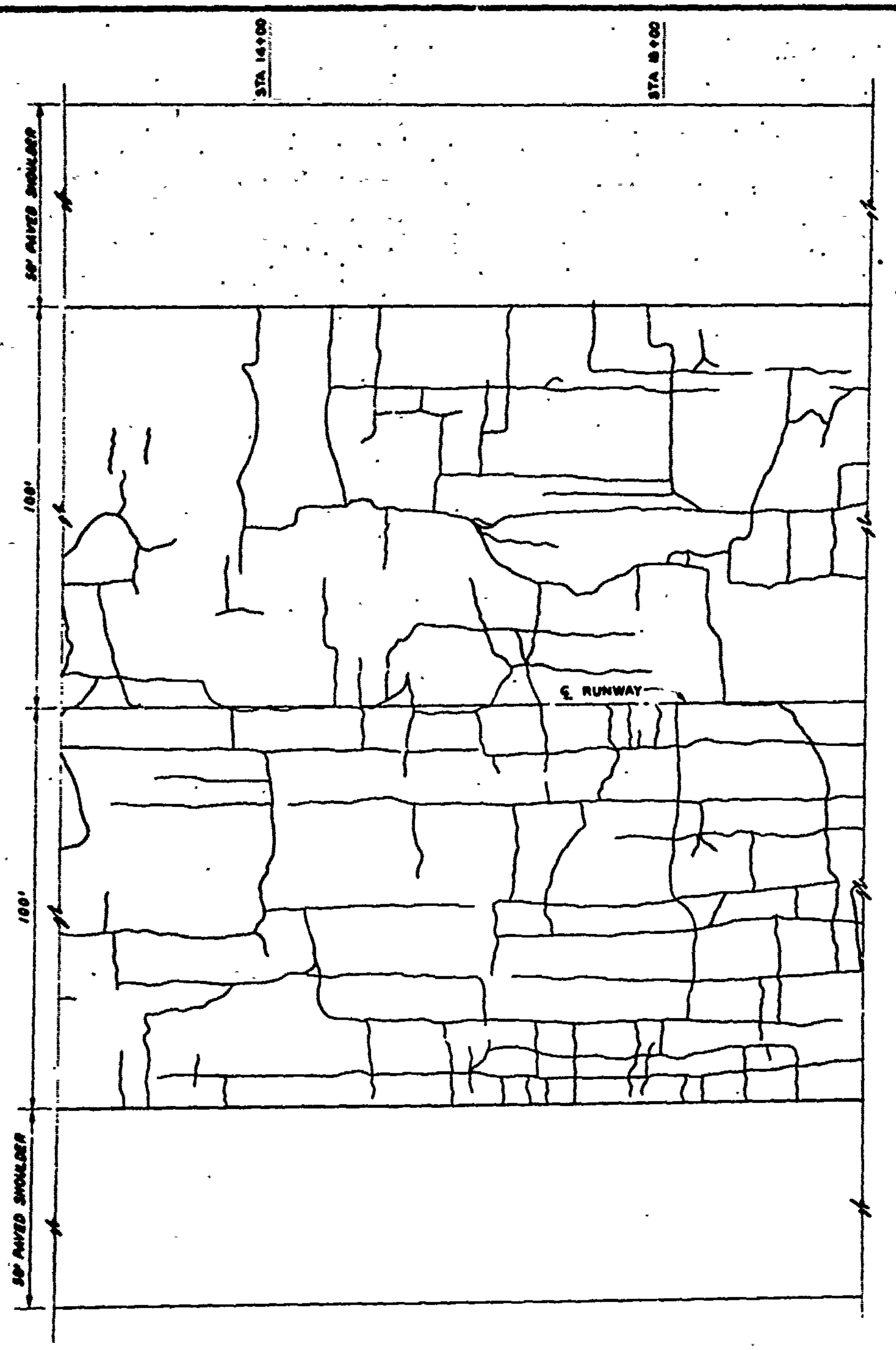


EXPERIMENTAL CRACK SEALING
THULE AIR BASE, GREENLAND

LOCATION OF TEST AREAS

SCALE
500 0 500 1000 1500 2000

PLATE 1

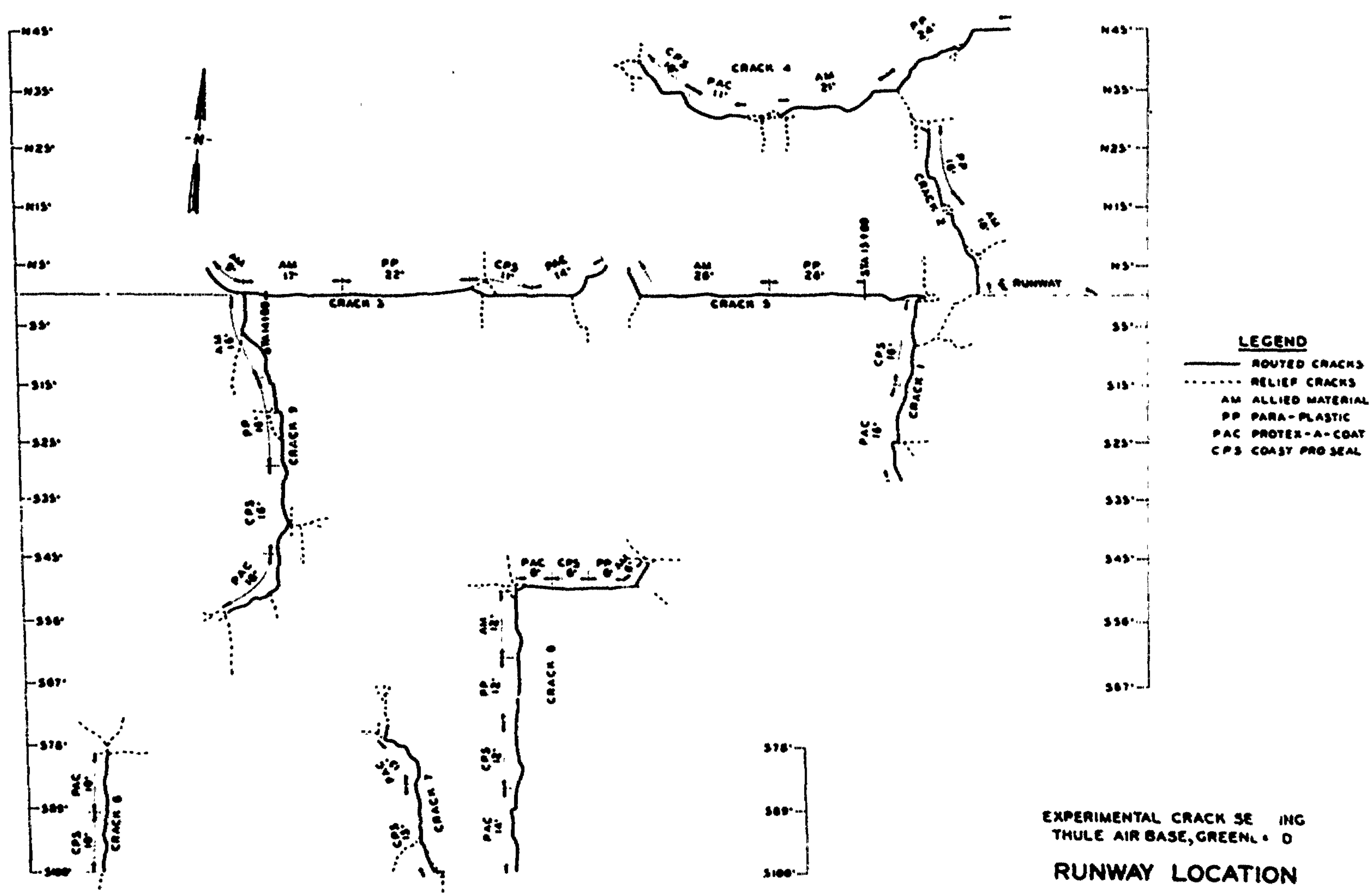


EXPERIMENTAL CRACK SEALING
THULE AIR BASE, GREENLAND

TYPICAL CRACKS IN MAIN RUNWAY

1957 SURVEY

PLATE



EXPERIMENTAL CRACK SE ING
THULE AIR BASE, GREEN. D

RUNWAY LOCATION

PLATE

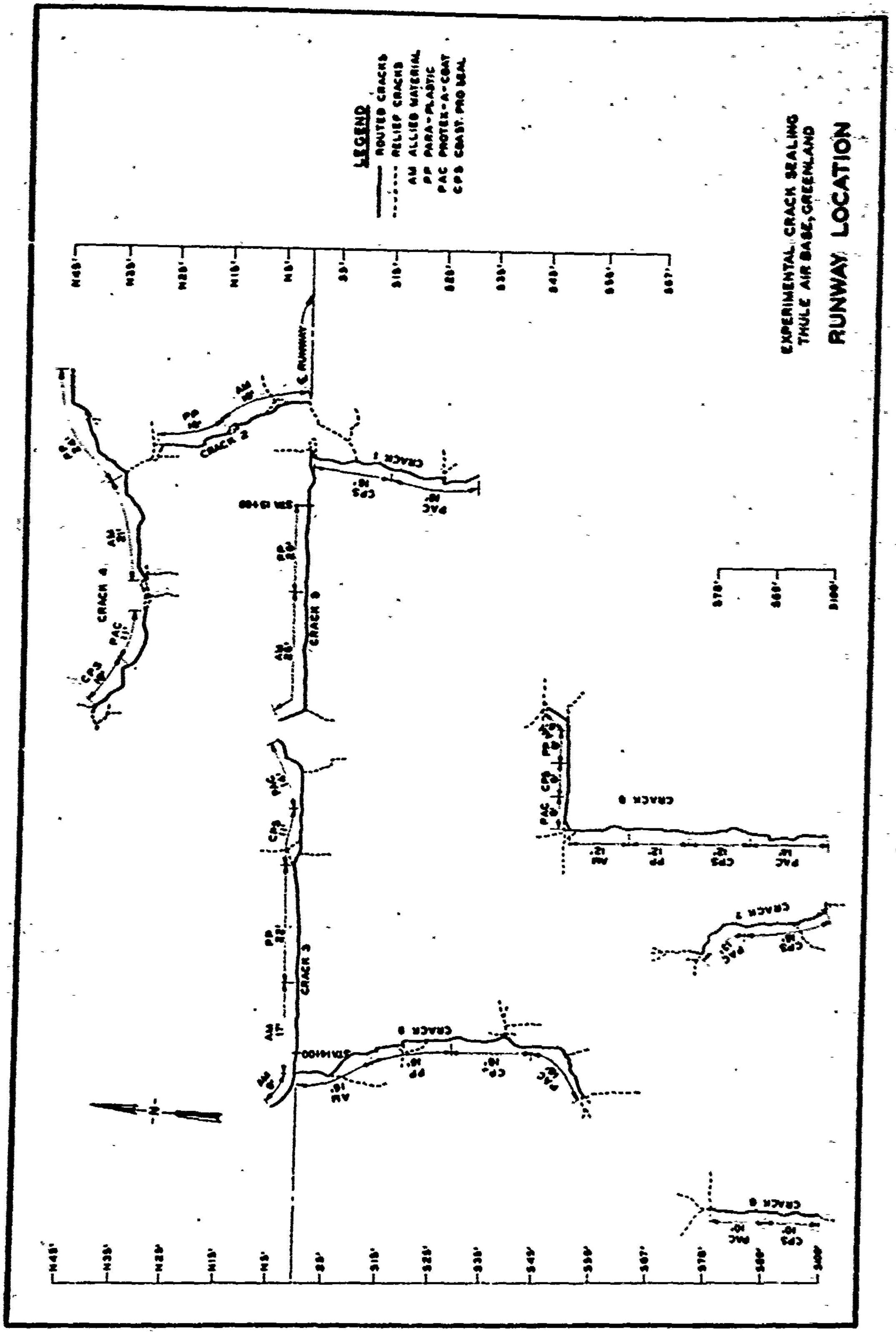
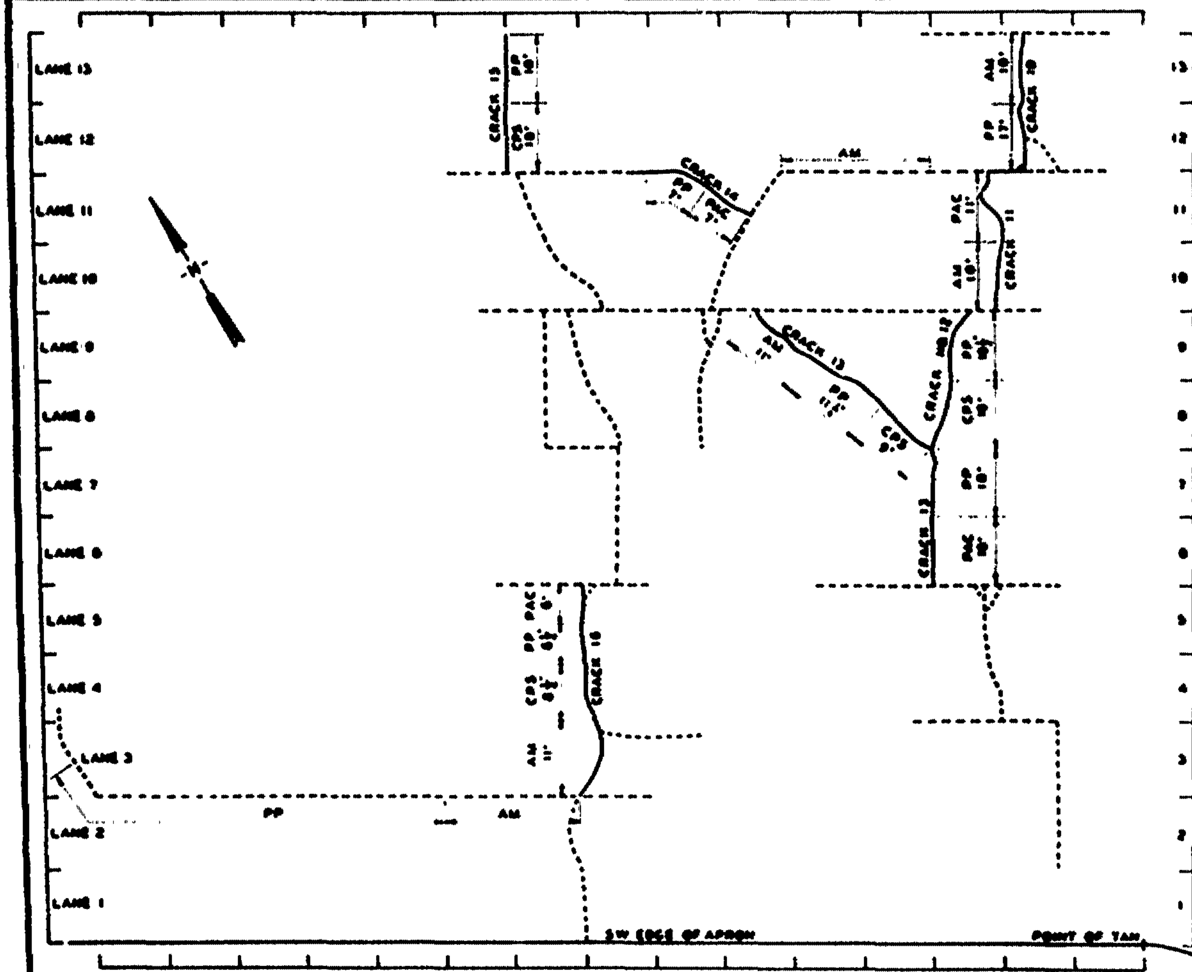

EXPERIMENTAL CRACK SEALING
THULE AIR BASE, GREENLAND
RUNWAY LOCATION
LEGEND
ROUTED CRACKS
RELIEF CRACKS
AM ALLIED MATERIAL
PP PARA-PLASTIC
PAC PROTEX-A-COAT
CPS COAST. PRO SEAL

PLATE 3



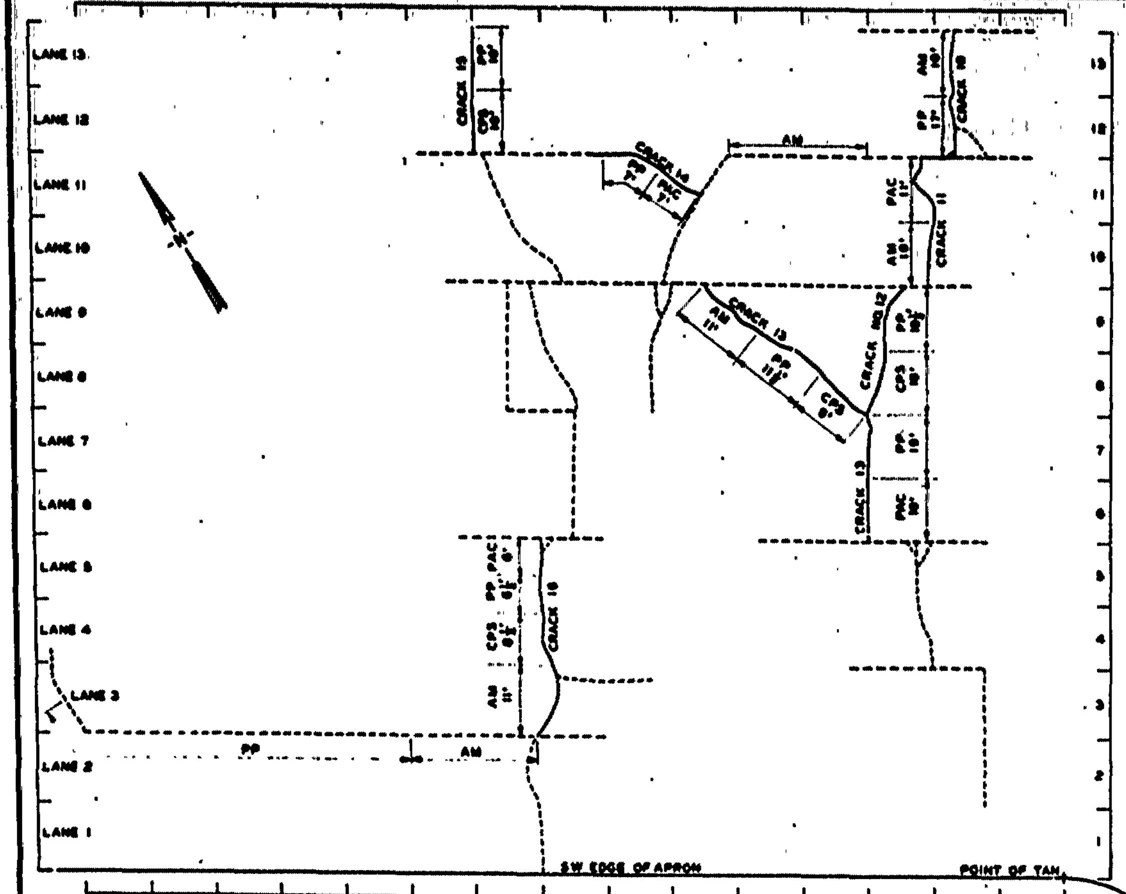
LEGEND

- ——— ROUTED CRACKS
- - - - - RELIEF CRACKS
- AM ALLIED MATERIAL
- PP PARA-PLASTIC
- PAC PROTEX-A-COAT
- CPS COAST PRO SEAL

EXPERIMENTAL CRACK SEALING
THULE AIR BASE, GREENLAND

NE WARM UP APRON LOCATION

PLATE 4



LEGEND

ROUTED CRACKS
RELIEF CRACKS
AM ALLIED MATERIAL
P.P PARA-PLASTIC
PAC PROTEK-A-COAT
CPS COAST PRO SEAL

EXPERIMENTAL CRACK SEALING
THULE AIR BASE, GREENLAND

NE WARM UP APRON LOCATION

PLATE 4